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ABSTRACT

Presented is a summary of the employment characteristics of recent science and engineering (S/E) graduates, based upon information collected in surveys of recent recipients in S/E fields. Findings reported in this study are based on survey data collected between 1974 and 1978. Charts and tables present in graph form information concerning the status in 1978 of S/E bachelor's degree recipients of 1972: the effects of work experience on labor market performance; the effects of advanced degrees on labor market performance; graduate education and salary; labor force participation rates; unemployment and employment rates of S/E bachelor's and master's degree recipients by field of degree and sex; and numbers of S/E degree recipients enrolled full-time in graduate school. Discussed are aspects of postgraduate and labor market behavior concentrating on two issues: (1) the acquisition of skill and its consequences for labor market performance; and (2) the effects of changes in the economic environment on labor market performance and graduate school enrollment. (CS)

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REVIEWS of data on Science Resources

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. 20550 NSF 80-311 NO. 36 MAY 1980

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Employment Characteristics of Recent Science and Engineering Graduates

The Effects of Work Experience, Advanced Degrees, and Business Cycles

This report, the second in a series on recent entrants into science and engineering (S/E) careers, is based on information collected in surveys of recent bachelor's- and master's-degree recipients in S/E fields. These surveys are one of three major data bases used by the National Science Foundation (NSF) to estimate the characteristics and activities of the U.S. S/E population. The findings reported in this study are based on survey data collected between 1974 and 1978.

Highlights

ECONOMIC CONDITIONS

- The recovery of the economy from the short, but severe, economic downturn that occurred in 1975 substantially improved 1978 employment opportunities for "recent" S/E graduates (i.e., two years since receipt of degrees), but had little effect on the likelihood that the employment would be in S/E jobs.

- Changing economic conditions over the 1974-78 period had little net effect on the propensity of recent S/E graduates to enroll full time in graduate school.

ADVANCED DEGREES

- Although economic fluctuations had little net effect on finding employment in S/E-related jobs (S/E utilization), the likelihood of being employed in such jobs was consistently higher for advanced degree-holders. In both 1976 and 1978 less than one-half of the employed recent baccalaureates were working in S/E jobs, while over three-fourths of the recent master's had such jobs. The relatively high rate of S/E utilization for recent S/E master's supports the hypothesis that this degree level is a requirement for entry into most S/E fields. A notable exception is the field of engineering.

- There was substantially more occupational variability in S/E utilization among baccalaureate recipients than among degree-holders at higher levels. Among the recent bachelor's-degree recipients with engineering degrees, the likelihood of being employed in S/E-related jobs was over four times as large (85 percent) as the comparable likelihood for those with social science degrees (20 percent). Similar, but smaller, differentials were noted among S/E master's-degree recipients (91 percent for engineers and 52 percent for social scientists). Among recent S/E Ph.D. recipients, S/E utilization rates exceeded 80 percent in each field.

- About one-third of the 1972 S/E-baccalaureate recipients had acquired an advanced degree by 1978. More than one-half of these took their degrees in non-S/E fields including such professional fields as medicine and dentistry, which generally require extensive undergraduate training in science.

- The effect of degree level on salaries was mixed. On an average, S/E master's-degree recipients earned about 8 percent more in 1978 than bachelor's from the same graduating cohort

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who had not gone on for advanced degrees; there was virtually no salary difference between the master's- and Ph.D.-holders. It should be noted, however, that the salary levels reported by Ph.D.-holders are, most likely, starting salaries. More pronounced salary differentials in favor of Ph.D.-holders are expected to develop as these degree-holders gain more work experience.

WORK EXPERIENCE

- The propensity of bachelor's degree-holders to work in science and engineering declines with years of work experience. Among men, the proportion employed in S/E jobs decreased from 50 percent for those with two years of work experience to 39 percent for those with six years of experience; among women, it declined from 33 percent to 19 percent.

- In 1978 the proportion of women S/E-baccalaureates from the 1972 graduating cohort, who were in the labor force six years, was substantially lower than that of the comparable 1976 cohort two years after receipt of their degrees. The lower rate of labor force participation may result partly from labor force withdrawal of women graduates who are assuming family responsibilities as they marry and have children.

Introduction

NSF has collected demographic and labor market data for each annual cohort of approximately 300,000 bachelor's- and 55,000 master's-S/E-degree recipients graduated since 1971. Although the primary objective of this data-collection effort has been to provide necessary input to the estimation of the characteristics and activities of the U.S. population of scientists and engineers, the information collected also has independent value as labor market indicators for scientists and engineers. These indicators can provide important early warning signals on impending changes in the supply[1] of scientists and engineers as well as valuable information on current demand conditions.

This report examines aspects of postgraduate and labor market behavior over time using information collected in 1974, 1976, and 1978 for the cohorts graduating in 1972, 1974, and 1976. It concentrates on two issues: (1) the acquisition of skill over time (where skill is defined in terms of formal training and on-the-job training acquired through work experience) and its consequences for labor market performance (defined in terms of participation in the labor force, employment and salary status, and characteristics of employment); and (2) the effects of changes in the economic environment on labor market performance.

The measures of labor market performance used in this report are essential (although not sufficient) to the determination of the extent to which the skills acquired by these individuals are utilized. The data on skill acquisition will be of value to educators, students, and planners. They inform them about current career choice patterns, which will ultimately affect the supply of scientists and engineers, and about the potential labor market payoffs to advanced degrees—improved employment and earnings opportunities.

The first section of the report addresses skill acquisition and its consequences by examining the experience of the 1972 cohort of S/E bachelor's-degree recipients measured six years after graduation (i.e., in 1978). The likelihood of acquiring advanced degrees and the effects of such education on unemployment, employment in S/E jobs, and earnings are examined. The second section addresses changes in general economic conditions and their consequences for (1) graduate school enrollment; (2) labor force participation (i.e., working or looking for a job); (3) unemployment; and (4) work in S/E jobs. The focus is on the employment status of the 1972, 1974, and 1976 graduating classes measured two years following graduation. In both sections, the analyses of labor market performance involves only those in the samples who were not full-time graduate students at the time of the survey.

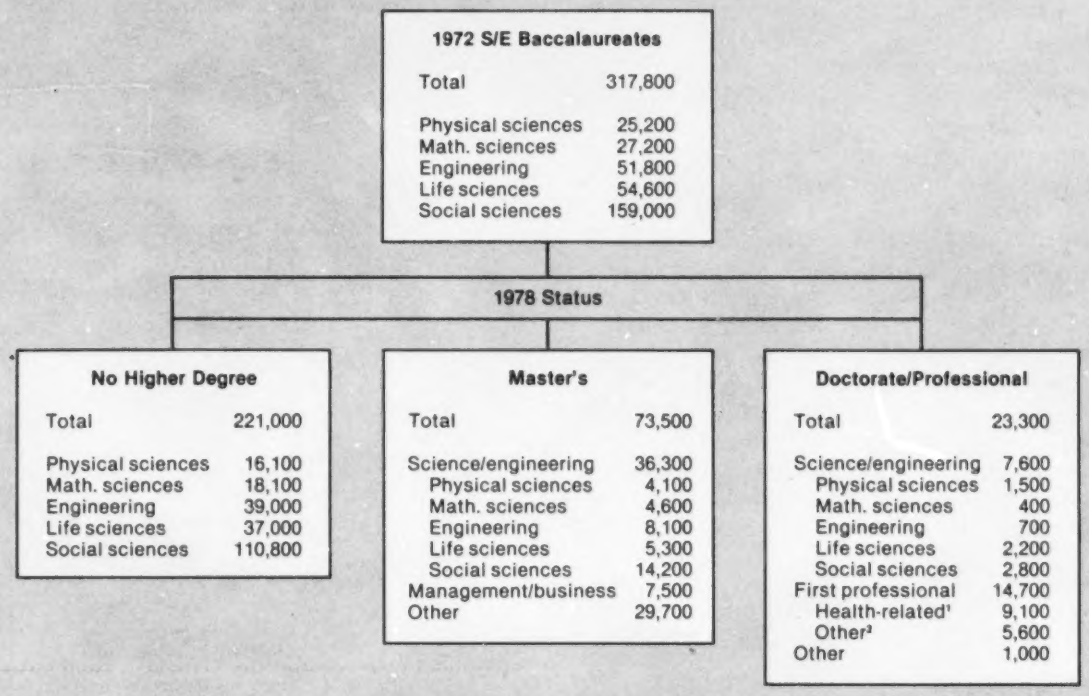
Six Years After the Bachelor's Degree

INVESTMENT IN FURTHER EDUCATION

While data on the annual production of S/E bachelor's and master's degrees provide important information about the potential new supply of scientists and engineers, they are not sufficient for estimating this supply. In many fields of science, the bachelor's degree is not an entry-level degree. Thus, in addition to knowing how many S/E

[1] Changes in supply occur through inflows and outflows from the existing stock of scientists and engineers. An important component of inflows is the number of new entrants to the stock. This number is, in turn, strongly influenced by recent S/E-degree recipients and their labor market behavior.

Chart 1. Graduate education pattern of 1972 science/engineering baccalaureate recipients: 1978



[1]Includes professional degrees in medicine, dentistry, pharmacy, and other health professions.
[2]Includes degrees in law and religion.
SOURCE: National Science Foundation

degrees are produced each year, it is also necessary to know how many of the bachelor's-degree recipients continue their schooling.

Chart 1 summarizes the advanced degree patterns of the 1972 S/E bachelor's cohort. Roughly 70 percent had not received an advanced degree by 1978. Earning an advanced degree entailed a substantial shift away from S/E fields of study. Of those who earned a master's degree, about one-half earned them in fields other than science and engineering. In addition, about 7 percent of the 1972 S/E bachelor's cohort had earned Ph.D.'s or equivalent first-professional degrees by 1978, most of these (approximately two-thirds) in non-S/E fields.

Table 1 displays the ratio of S/E advanced degrees to bachelor's degrees for the 1972 cohort. The numerator of this ratio includes both those individuals who received advanced degrees in their undergraduate field as well as field-switchers. A larger fraction of the 1972 cohort had earned master's degrees in physical and mathematical sciences and in engineering (about 16 percent) than in the life and social sciences (around

Table 1. Advanced degrees per 100 baccalaureates by level and field of degree and sex: 1972 science/engineering baccalaureate cohort in 1978

Level and field of degree	Total	Men	Women
Master's	11.4	12.2	9.6
Physical sciences	16.2	16.9	12.8
Mathematical sciences	16.9	19.1	12.8
Engineering	15.6	15.7	12.3
Life sciences	9.7	8.4	14.0
Social sciences	9.0	9.6	8.0
Doctorates	2.4	2.7	1.6
Physical sciences	6.0	6.6	3.2
Mathematical sciences	1.4	2.2	(1)
Engineering	1.4	1.4	(1)
Life sciences	4.1	4.3	3.9
Social sciences	1.7	2.0	1.3

[1]Less than .05 percent.

Source: National Science Foundation.

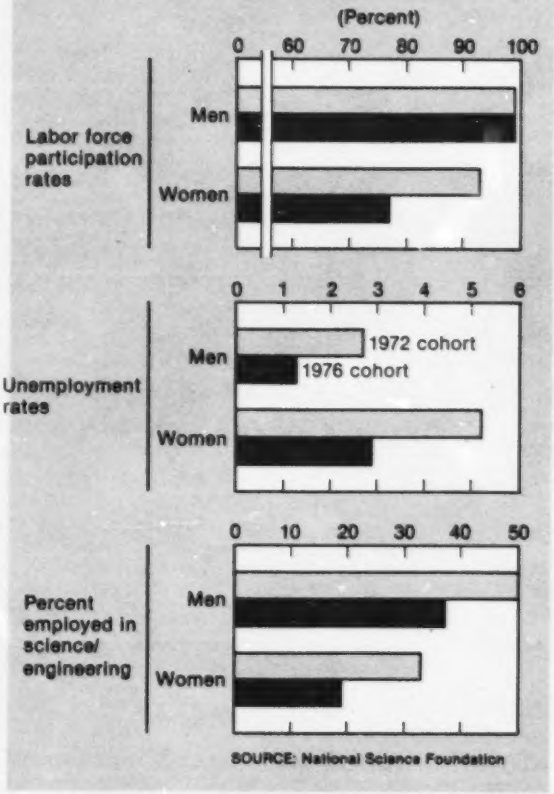
10 percent). The ratio of doctorates to baccalaureates were higher in the physical and life sciences (6.0 percent and 4.1 percent, respectively) than in the social sciences (1.7 percent) and the mathematical sciences and engineering (1.4 percent).

The ratio of master's to bachelor's degrees was generally lower among women than among men (9.6 percent vs. 12.2 percent). These lower female ratios are in contrast to their higher propensities to continue graduate training in non-S/E fields. Substantially more than one-half of the women S/E baccalaureate-holders earning master's degrees earned them in non-S/E fields.[3] In general, relatively few women earn postgraduate degrees in S/E fields. Of all master's degrees awarded to women in the United States in 1977, about 91 percent were in non-S/E fields; 56 percent in the field of education, alone.[4] Larger sex differentials in these ratios appear at the doctorate level. The ratio for males in science (3.1 percent) is almost twice that of females (1.6 percent). However, women have recently been increasing their share of earned S/E degrees at all levels.

THE EFFECTS OF WORK EXPERIENCE ON LABOR MARKET PERFORMANCE

The data from the survey series indicate that length of time since degree—a proxy for work experience—had a substantial effect on the labor market characteristics of S/E baccalaureates. Chart 2 compares selected characteristics of the 1976 and 1972 cohorts as measured in 1978—that is, two and six years after graduation. Both cohorts include only individuals who held an S/E baccalaureate as their highest degree in 1978. For men, the relation between labor force participation rates (i.e., the proportion of these cohorts who were working or looking for work) and time since degree remained unchanged at about 99 percent for both cohorts, while for women, participation rates declined markedly (from 93 percent two years after the degree to 77 percent six years after the degree). A factor contributing to this decline may be withdrawal from the labor force

Chart 2. Selected 1978 employment characteristics of 1972 and 1976 science/engineering baccalaureate recipients



SOURCE: National Science Foundation

on the part of women as they marry and have children.[5]

The data also show a sharp decline in unemployment rates among both men and women as they gain experience. Although unemployment rates were essentially halved, those for women remain about twice those of men for both the 1972 and 1976 cohorts.

The propensity to work in science and engineering declines with years of work experience. Among men, the proportion employed in S/E jobs decreased from 50 percent for the 1976 cohort (2

[3] Of the 23,900 women who had earned master's degrees by 1978, roughly 8,600 (36 percent) earned them in S/E fields.

[4] Department of Health, Education, and Welfare, National Center for Education Statistics, *Earned Degrees Conferred 1976-1977* (Washington, D.C.: U.S. Government Printing Office.)

[5] The decline in the labor force participation rate of young married women is well documented. For example, in 1977 the participation rate of single women between 25 to 34 years of age, with four or more years of college, was 95.1 percent, whereas the corresponding rate for married women, with husbands present, was 62.9 percent. See Department of Labor, Bureau of Labor Statistics, *Educational Attainment of Workers, March 1977*, Special Labor Force Report 209 (Washington, D.C.).

years of work experience) to 39 percent for the 1972 cohort (6 years of experience); among women, it declined from 33 percent to 19 percent. The factors underlying this decline are not apparent. These moves may result either from preferences of the employees for better job opportunities in non-S/E fields or preferences of the employers for particular types of skills. In the latter case employers may prefer more recent degree recipients to capitalize on the newest concepts and techniques. An additional explanation is suggested by recent evidence of an upgrading of educational attainment within some S/E occupations. For example, the proportion of the *total R&D work force* with Ph.D.'s increased during the 1973-77 period.[5] This upgrading may have also contributed to the decline in S/E employment on the part of the 1972 cohort of S/E bachelor's degree-holders during the ensuing six years as employers substituted doctorate-holders for nondoctorate-holders.

THE EFFECTS OF ADVANCED DEGREES ON LABOR MARKET PERFORMANCE

The importance of graduate education is recognized in most professions. Increasingly, the undergraduate degree is not considered sufficient for professional standing in many science fields.

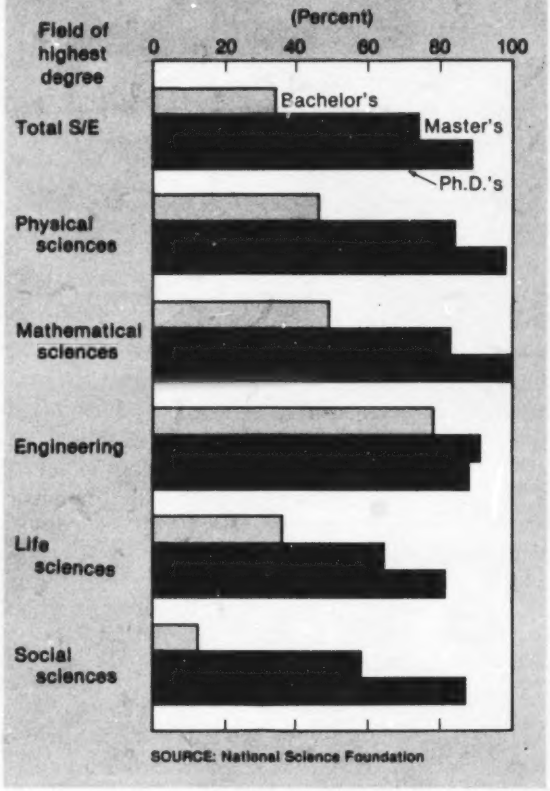
Thus, one reason for obtaining an advanced degree in science and engineering is the enhancement of employment opportunities, especially in science. However, while the 1978 unemployment rate for those from the 1972 graduating cohort who had not earned an advanced degree was 1.7 percent, the rate for those earning an S/E master's degree was, counter intuitively, 4.2 percent. In contrast, the 1978 unemployment rate for individuals from the 1972 cohort who earned an S/E Ph.D. was more consistent with intuition, 0.3 percent, substantially lower than the rate for both S/E bachelor's and S/E master's degree-holders.

Earning an advanced S/E degree increased the likelihood of working in S/E-related jobs, especially in the science fields. This increase was especially evident in the social science fields and, except in the case of engineering, occurred at every degree level (chart 3). The acquisition of an S/E graduate degree also has a strong positive influence on the ability to find employment in one's field of study. (chart 4). This effect is generally attributed to the higher level of expertise as well as the greater commitment to a given field of inquiry which are associated with additional schooling. The generally accepted notion that the S/E baccalaureate is not recognized to be sufficient educational qualification for professional employment in many S/E occupations—notably in the sciences—is also consistent with these findings. Overall, about one-quarter (26 percent) from the 1972 graduating cohort were employed within their field of study[6] six years later. For advanced-degree recipients in S/E

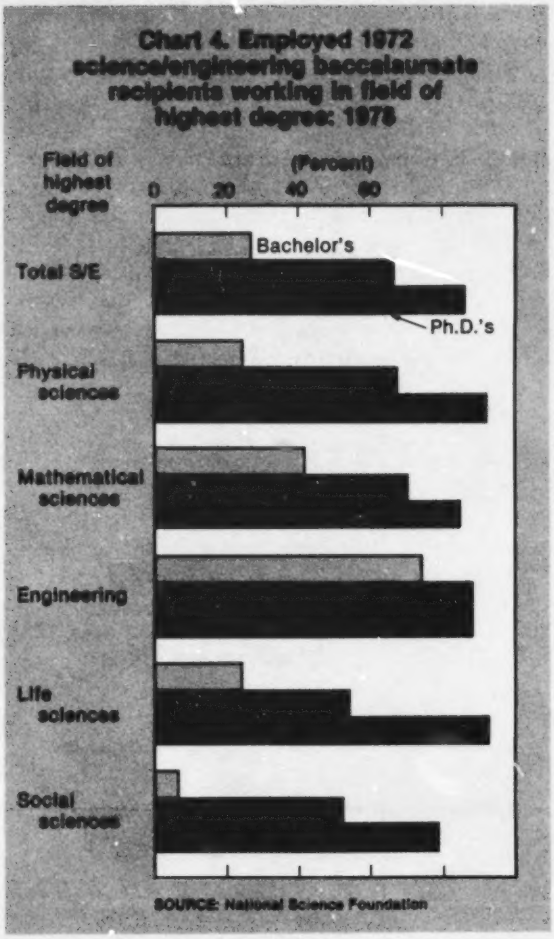
[5] National Science Foundation. "Work Activities of Doctoral Scientists and Engineers Show Substantial Change Between 1973 and 1977," *Science Resources Studies Highlights* (NSF 78-316) (Washington, D.C., October 4, 1978).

[6] For purposes of this analysis both the fields of degree and employment were classified in terms of the following broad categories: physical sciences; mathematics, including computer science; engineering; life sciences; and social sciences, including psychology.

Chart 3. Employed 1972 science/engineering baccalaureate-degree recipients working in S/E jobs by field of highest degree: 1978



SOURCE: National Science Foundation



fields, the ability to find employment within the field of degree was substantially greater; among master's- and doctorate-degree recipients the corresponding employment levels were 66 percent and 86 percent, respectively. S/E employment rates display a considerable amount of field variability. Thus, while an advanced degree in an S/E field generally increases the likelihood of employment within that field, this effect is much more pronounced in the science fields than it is in engineering (chart 3).

GRADUATE EDUCATION AND SALARY

Information on the salary levels reported by the 1972 cohort as of 1978 are presented in table 2. The salary pattern of bachelor's-degree recipients, which reflects up to six years of work experience, displays substantial dispersion by field. The strong market demand for engineers at the bachelor's-degree level is reflected by the salaries earned by these individuals. Their 1978 median annual salary was 12 percent higher than the overall median salary level and about 35 percent higher than the salaries earned by individuals with a baccalaureate in the life and social sciences.

The effect of a shift to non-S/E fields had a substantial effect on salaries but this effect varied depending on the non-S/E field to which the shift has been made. The highest median annual salary was reported by management/business school graduates; and this was higher than that of S/E-degree recipients. However, the median annual salary of the remaining individuals with master's degrees in other non-S/E fields, collectively, was substantially lower than those reported by their colleagues in S/E or management/business fields.

Differences in salaries among groups classified by level of degree reflect the interplay of several factors. For example, while the salary levels of the bachelor's group reflect up to six years of work experience, salaries of other groups do not. In fact, given that the median lapsed time between receipt of baccalaureate and S/E doctorate has recently been 7½ years,[7] the median salary levels

[7] National Research Council. *Summary Report 1978. Doctorate Recipients from United States Universities* (Washington, D.C., March 1979).

Table 2. Median annual salaries by field and level of highest degree: 1972 science/engineering baccalaureate cohort in 1978

Field of highest degree	Bachelor's	Master's	Doctorates
Total	$18,200	$18,900	$19,000
Total science/engineering	18,200	19,600	19,500
Physical sciences	16,200	17,700	20,500
Mathematical sciences	16,700	20,400	(1)
Engineering	20,400	21,100	(1)
Life sciences	15,100	15,100	(1)
Social sciences	14,900	16,100	18,400
Nonscience/engineering	—	—	—
Management/business	(2)	21,600	NA
First-professional	(2)	NA	17,800
Health-related	(2)	NA	16,900
Other	(2)	NA	20,300
Other	(2)	13,700	19,600

[1] Too few cases to report median.
[2] Not applicable.

Source: National Science Foundation.

for Ph.D.-holders as well as professional-degree recipients appear to represent essentially starting salaries. The observed degree level differences in salaries for a given cohort of S/E baccalaureates tend to understate the true payoff to the additional degree because they fail to control for differences in work experience.

The median annual salary levels of master's-degree recipients in S/E fields are almost 8 percent higher than the analogous levels for the bachelor's group. The largest immediate payoff to earning a master's degree appears to be in the mathematical sciences, where the master's degree commands a 22-percent premium. In contrast, there appears to be no immediate payoff in the life sciences.

The starting salaries of S/E Ph.D. recipients are also about 7 percent higher than those of the experienced bachelor's group. Although there is practically no difference between the salaries of S/E master's degree-holders and S/E Ph.D.-holders from the 1972 cohort, when averaged over all fields, the data indicate substantial within field payoffs.

Business Cycles and the Employment of New Scientists and Engineers

Scientists and engineers have traditionally fared well in the U.S. labor market. Unemployment rates for scientists and engineers have been substantially and consistently lower than the national averages for all workers over the last decade (chart 5). Nevertheless, the relative labor market performance of scientists and engineers is not immune to fluctuations in economic conditions. This may especially be so for new S/E-degree recipients upon graduation since this group, especially bachelor's- and master's-degree recipients, has probably had little or no previous work experience.

This section of the report examines whether fluctuations in the level of economic activity affect new S/E-degree recipients and, if so, how. Specifically, it investigates how these fluctuations might impact on the employment and labor force characteristics and the graduate school attendance propensities of these degree recipients. The effects of these fluctuations are captured by examining data collected for several cohorts, two years following graduation. These data, which span the 1974-75 economic recession, were drawn from the following S/E graduating cohorts:

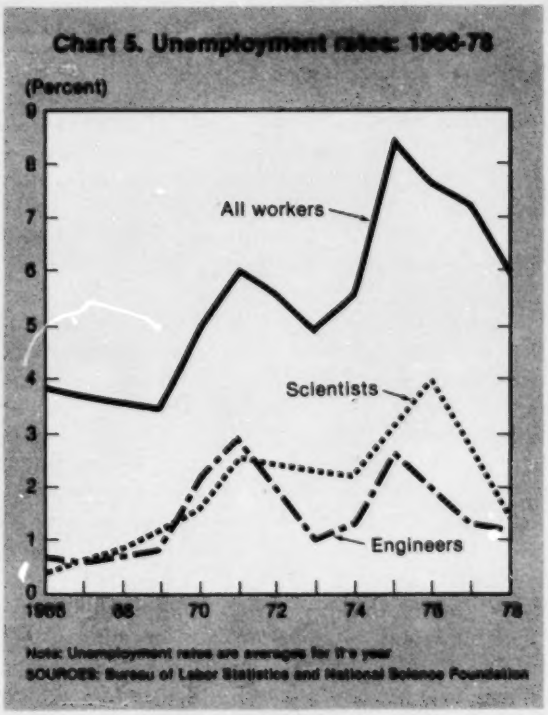
Bachelor's-Degree Recipients
- 1972 Graduating Cohort in 1974
- 1974 Graduating Cohort in 1976
- 1976 Graduating Cohort in 1978

Master's-Degree Recipients
- 1974 Graduating Cohort in 1976
- 1976 Graduating Cohort in 1978

LABOR FORCE PARTICIPATION RATES

The fraction of the S/E population not in the labor force is an indicator of the potential supply of scientists and engineers that is not available to contribute to the output of science and technology. Low rates of labor force participation can mean that society is not fully utilizing the scientific and technical skills embodied in the population.

The labor force participation rates of S/E baccalaureate recipients from the 1972, 1974, and 1976 graduation cohorts were consistently high when measured two years later and there appeared to be no systematic fluctuation in this measure over time. Labor force participation rates ranged around 90 percent among science graduates and were close to 100 percent for engineering-degree recipients. The difference between scientists and



engineers may reflect a greater relative demand for engineers and the greater proportion of engineering graduates who are males.

The participation rate of women S/E graduates was only slightly lower than men. In all three survey years the labor force participation rates of women S/E bachelor's-degree recipients were over 90 percent. However, as noted earlier, the labor force participation rate of women declined substantially as time since degree increased. Nevertheless, considering new graduates only, women accounted for a significant fraction of the supply of new scientists and engineers during this period. In the 1976 cohort of S/E baccalaureate recipients, for example, women accounted for about one-third of the individuals from this graduating cohort who were in the labor force two years later.

Labor force entrance rates among recent S/E master's-degree recipients do not differ substantially from those of baccalaureate-holders. Among 1976 graduates at the master's-degree level, about 98 percent and 91 percent of men and women, respectively, were in the U.S. labor force when surveyed two years after graduation. As with bachelor's-degree recipients, participation rates for women were only slightly lower than those for men.

UNEMPLOYMENT RATES

The high rates of labor force participation mentioned above indicate high rates of availability. They do not necessarily imply high rates of utilization. In order to more fully evaluate utilization one must also have some notion of the fraction of those available who have no jobs and are looking for work, as measured by the unemployment rate.

Chart 6 depicts the unemployment rates for various subpopulations of recent S/E bachelor's-degree recipients two years following graduation. A substantial amount of variability in the labor market success of these individuals is evident during the 1974-78 period.

Paralleling fluctuations in economic conditions during the 1974-78 period, unemployment rates of new S/E baccalaureates (two years out of college) rose from 1974 to 1976 and then declined from 1976 to 1978. This pattern of change was qualitatively similar to fluctuations in unemployment rates exhibited by all workers and by the total S/E labor force during the period. Thus, the general recession in the U.S. economy, which reached its trough in 1975, appeared to have inhibited the employment success of S/E graduates. With the general improvement in the economy in the following two years, the unemployment rate of recent S/E degree-holders declined markedly to 3.5 percent in mid-1978, surpassing the reduction in the unemployment rate for the total labor force during this same period which fell to 6.0 percent.

This improvement in employment opportunities among bachelor's-degree recipients was evident in all S/E fields.* However, unemployment rates for science-degree recipients during the 1974-78 period were consistently higher than the rate for engineering graduates suggesting a stronger relative demand for engineers at the bachelor's-degree level.

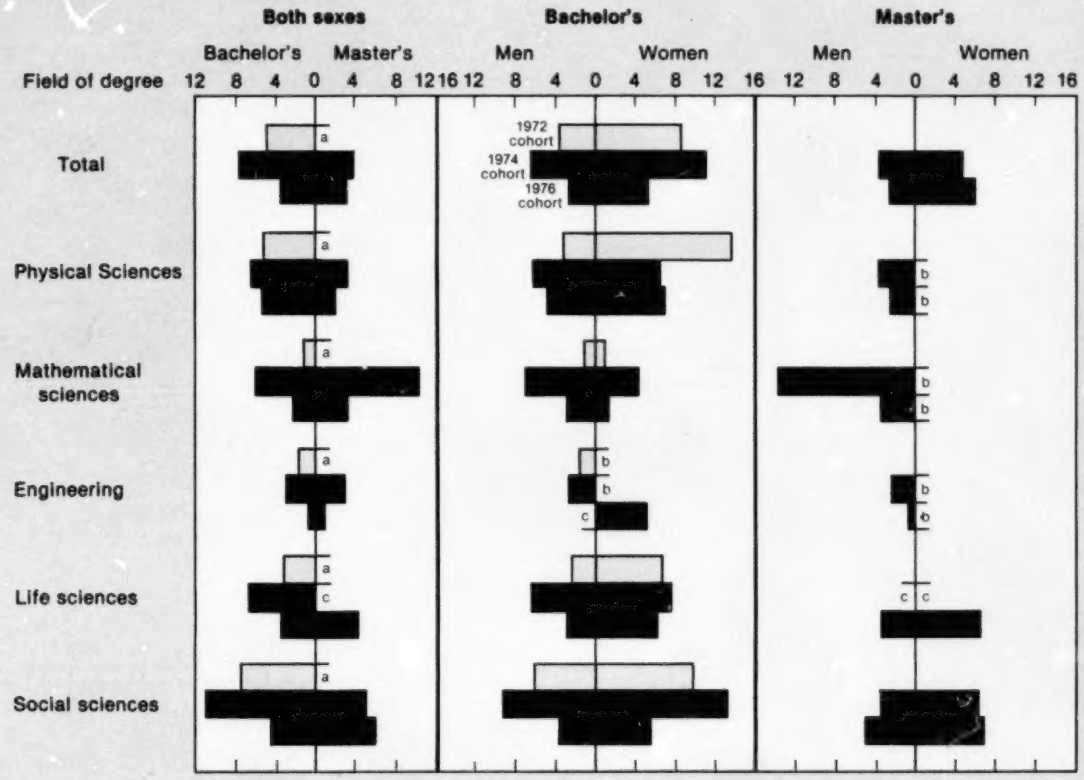
The 1976 unemployment rates for master's-degree recipients in science and engineering were substantially lower than those for baccalaureate-holders in most science fields—the overall rate for science-degree recipients was 9.0 percent for bachelor's versus 4.8 percent for master's. Among engineering graduates, however, unemployment rates of bachelor's and master's degree-holders were comparable.

These data indicate that the unfavorable national employment conditions in 1976 had a much greater impact on bachelor's degree-holders in the sciences compared to those holding the master's degree in the sciences. Thus the payoff—in terms of improved employment opportunities—of investing in a master's degree in science fields appears to be greater than the payoff to a master's in engineering. The higher and more stable demand for engineering graduates in both base years and at both degree levels provides further evidence in support of the general hypothesis that, currently, the bachelor's degree is the entry degree into the engineering professions.

A comparison of the 1976 and 1978 status reveals a much sharper decline in unemployment rates for baccalaureate recipients relative to those attaining a master's degree. It should be noted, however, that in 1978 unemployment rates of bachelor's and master's degree-holders were essentially equal. Thus, the value of the master's degree was much more evident in 1976, when employment

*Recall that for purposes of this analysis both the fields of degree and fields of employment were classified in terms of broad categories. (See footnote 6.)

Chart 6. Unemployment rates of science/engineering bachelor's- and master's-degree recipients by field of degree and sex: 2 years after graduation



[a]Data not available.
[b]No unemployment rate computed for groups with less than 1500 in labor force.
[c]Less than 0.5 percent.
SOURCE: National Science Foundation

conditions in the U.S. economy were relatively poor, than in 1978 by which time economic conditions had improved. Consequently, one value of a master's degree may be better access to jobs in periods of relatively slack demand. This effect is consistent with general evidence that individuals with more schooling experience have greater employment stability over business cycles and with human capital theory suggesting that firms will tend to "hoard" high-skilled personnel during business recessions.[9]

However, the difference between unemployment rates of bachelor's- and master's-degree recipients is very much influenced by work experience. As noted earlier the unemployment rate of 1972 bachelor's-degree recipients with six years of work experience (i.e., those who had not acquired an advanced degree) was lower than that for individuals who had postponed their entry into the labor force to acquire a master's degree.

Irrespective of the base year or degree level, the overall unemployment rates of recent women S/E-degree recipients were about twice those observed for men. This disparity—especially at the bachelor's-degree level—shows in all S/E fields of study except for the mathematical sci-

[9]See for example, Gary S. Becker, *Human Capital* 2nd ed., (New York: Columbia University Press, 1975).

ences. In those fields, women had as much or better success in obtaining postgraduation employment as their male colleagues. It should be noted that computer scientists, currently in demand, are included in the major field of mathematical sciences.

Higher unemployment rates among women is a persistent finding within the S/E labor market. While the reasons for it are not clearly understood, a number of factors seem involved. First, women tend to be concentrated in the social sciences, which typically have exhibited higher unemployment rates than the natural sciences and engineering. Second, women, particularly those who are married, may have more stringent job requirements—e.g., strong locational preferences or hours of employment and may therefore spend more time searching for the "right" job. Third, because of nonlabor market activities (including perceived family responsibilities) women may tend to enter and leave the labor force with more frequency than men, thereby experiencing a higher frictional unemployment rate. Finally women—even those with Ph.D.'s—may be victims of discrimination in employment despite the vigorous affirmative action programs which have been implemented in recent years.

EMPLOYMENT IN SCIENCE AND ENGINEERING

The labor force participation and unemployment rates discussed above provide indications of the degree of availability and utilization of scientists and engineers for employment of any kind. However, in order to assess their contribution to the output of science and technology, it is not sufficient to examine their levels of utilization in all types of employment. It is also necessary to examine their levels of utilization in S/E jobs.

In 1976 and 1978 about 45 percent of the bachelor's-degree recipients in S/E fields were employed in S/E jobs two years after graduation.[10] This stability in S/E employment over business cycles appears not to be directly related to the unemployment rates experienced by these two graduating cohorts which declined markedly between 1976 and 1978.[11] Thus, while the employment opportunities afforded young S/E baccalaureate recipients showed substantial improvement during the 2-year period, their opportunity for employment in *S/E occupations* did not. This finding is consistent with recent data which indicate that in private industry (the largest employer of scientists and engineers at the bachelor's-degree level) the growth in the number of individuals in nontechnical activities has exceeded the number in technical activities.[12] Indeed, data regarding the 1974 and 1976 cohorts of S/E baccalaureate recipients show that the growth in the number of individuals in non-S/E employment (11 percent) exceeded the growth in S/E employment (6 percent).

The propensity to work in science or engineering varies substantially by field of degree and sex. Among 1976 graduates at the bachelor's level, for example, about 85 percent of the employed engineering-degree recipients were employed in S/E jobs, a finding which is in sharp contrast with science degree-holders, of whom about 35 percent were so employed. Moreover, among science fields there is pronounced variability. For example, the S/E employment rate among physical and mathematical scientists was about 70 percent, while the rate for social scientists was about 20 percent (chart 7).

The data also show that the S/E employment level for women is considerably lower than that for men. Among the combined S/E bachelor's-degree recipients, for example, about one-third of the employed women were in S/E jobs as compared with one-half of the employed men. Much of the difference in S/E utilization between men and women can be traced to the different concentrations in the various fields of science and engineering. When the fields of engineering—with high S/E employment but few women—and social sciences—with low S/E employment but relatively large numbers of women—are eliminated, the S/E employment utilization levels are about 55 percent for both sexes.

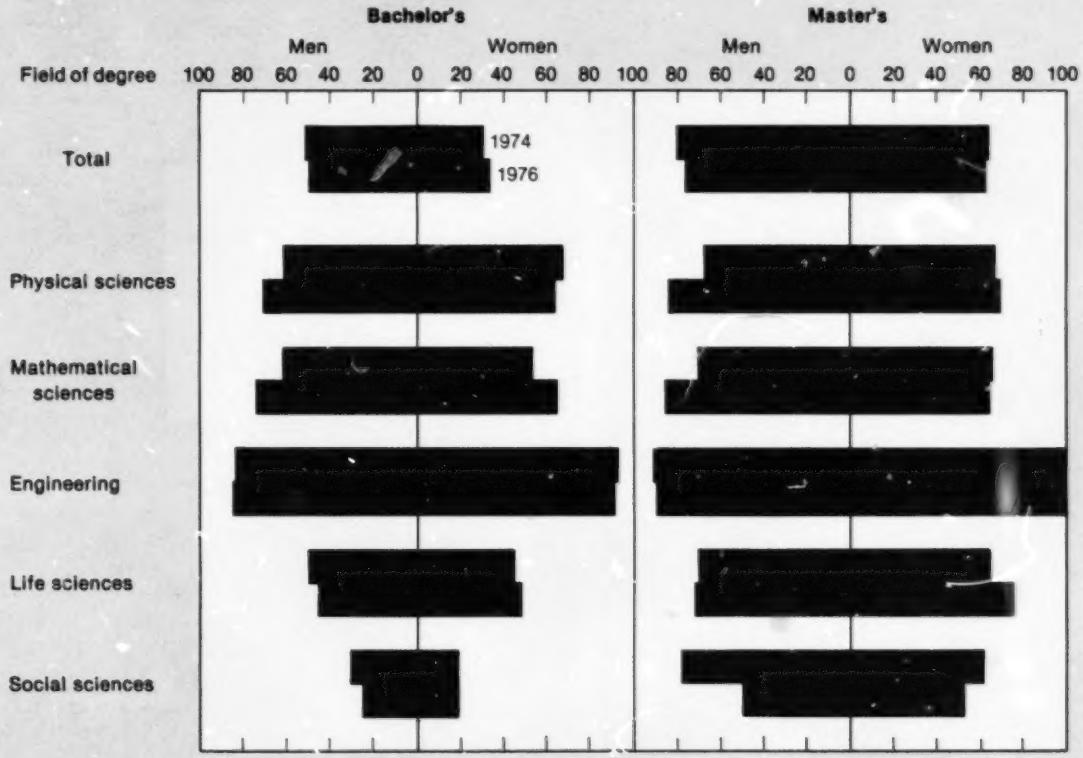
There is a positive association between the acquisition of a master's degree in science and engineering and the ability to gain S/E employment. Among 1976 master's graduates, about three-fourths (73 percent) were employed in S/E jobs (compared to 45 percent for bachelor's degree-holders). This association was found in all S/E-degree fields. S/E employment among women master's degree-holders from the 1976 graduating

[10] However, as noted earlier, the S/E utilization rate of bachelor's-degree recipients with six years of experience was only 38 percent.

[11] See supra, page 8.

[12] National Science Board, *Science Indicators 1978*, (NSB 79-1) (Washington, D.C. 20402: U.S. Government Printing Office 1979.)

Chart 7. 1974 and 1976 science/engineering bachelor's- and master's-degree recipients working in S/E jobs by field of degree and sex: 2 years after graduation



SOURCE: National Science Foundation

cohort still lagged somewhat behind that of men (62 percent versus 77 percent). The differential had decreased somewhat, however, from that observed for bachelor's degree-holders. These findings suggest that the attainment of an advanced S/E degree appears to have a more pronounced effect on women degree-holders (compared to men)—and that while the sex differential in S/E utilization rates is reduced, it is not eliminated.

GRADUATE SCHOOL ATTENDANCE

Changing economic conditions appear to have had little overall effect on full-time graduate school enrollments during this period. About one-fifth of the baccalaureate-holders and about one-sixth of the master's-degree recipients were enrolled in graduate school on a full-time basis two years after graduation.[13] The difference in enrollment rates, however, between men and women at the postbaccalaureate level appear to have narrowed. The enrollment rates for women have shown a steady increase during this period whereas those of men have not. This effect is consistent with other recent data which show that in fall 1978 one-half of all students in institutions of higher education were women.[14] In fact, in non-S/E fields, the number of 1976-77 women master's-

[13] Note that these data describe full-time graduate school enrollment rates only; graduate-degree completion rates for the 1972 cohort which also reflect the effects of part-time graduate school enrollments, are discussed above. See supra page 3.

[14] Department of Health, Education and Welfare, National Center for Education Statistics, Survey of Opening *Fall Enrollment in Higher Education, 1978* (unpublished tabulations).

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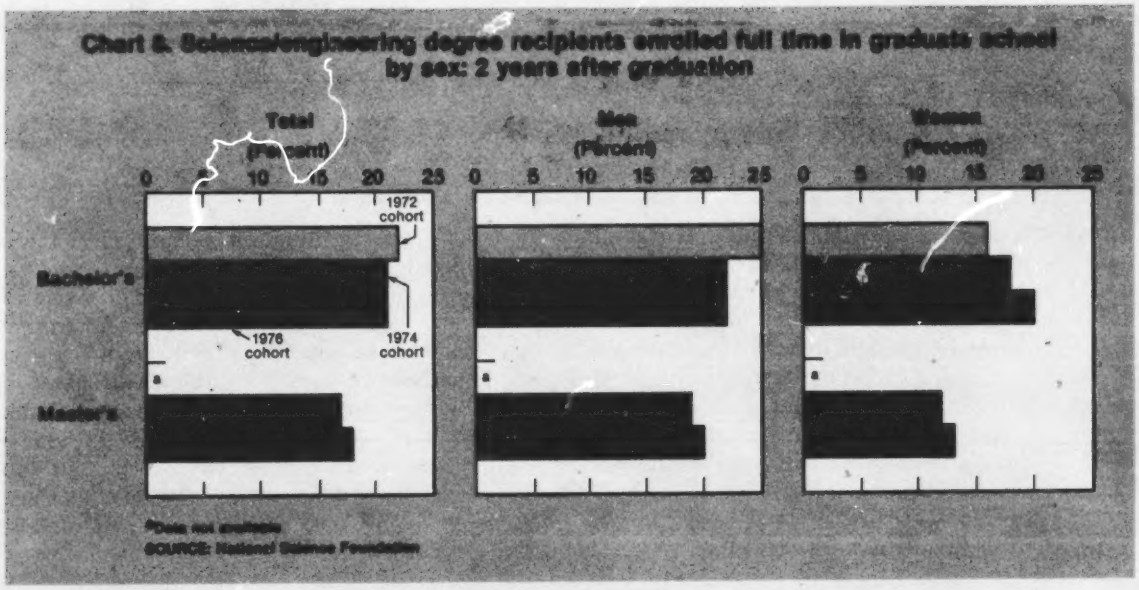

degree recipients exceeds that of men.[15] Following the receipt of the S/E master's degree, however, full-time graduate school enrollment of men (about 20 percent) was substantially higher than that of women (about 12 percent) in both survey years, although there was a slight increase in full-time enrollment rates for each sex during this period (chart 8).

[15] Department of Health, Education and Welfare, National Center for Education Statistics, *Earned Degrees Conferred, 1976-1977* op. cit.

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